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## Electromagnetically induced transparency with localized impurity electron spins in a semiconductor

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## PROPOSITIONS

### ***Belonging to the thesis***

*Electromagnetically induced transparency with localized impurity electron spins in a semiconductor*

*by*

**Alok Chaubal**

1. The good optical properties of GaAs and its superior technological maturity for material growth and device fabrication make it a preferred material for exploring the behavior of electromagnetically induced transparency (EIT) in solid state. However, for actual applications of EIT, material systems with significantly longer electronic spin coherence times will prevail.

#### ***Chapters 2 and 4 of the thesis***

2. Interpreting the results of magneto-spectroscopy studies of donor-bound excitons in semiconductors requires improvements of state-of-the-art theoretical descriptions. The path to success will profit more from an approach that starts with simple phenomenological model systems than from an *ab initio* approach.

#### ***Chapter 3 of the thesis***

3. In bulk low-doped n-GaAs, dynamic nuclear polarization can be used to prepare long-lived out-of-equilibrium states of the nuclear spin polarization within the volumes of the donor-bound electron wave functions. However, preparing such states is limited by the diffusion of nuclear spin polarization out of these volumes. Achieving a precise and homogenous polarization at and around donor sites can therefore not be achieved via driving optical transitions to donor-bound exciton states, and can be realized better via driving transitions to free-exciton states.

#### ***Chapter 4 of the thesis***

4. Electromagnetically induced transparency can function as a sensitive tool to detect miniscule shifts of energy levels due environmental disturbances.

#### ***Chapter 4 of the thesis***

5. To flourish in industry, one can be either a people manager, or a project manager, or a developer. On contrary, to flourish in academia, one has to be a good people person with project management skills and having innovative ideas. Research groups in academia with many PhD students striving for success are therefore a more fruitful environment for the development of new knowledge and ideas.
6. There are striking coincidences in today's technology and old Sanskrit epics from ancient India when explained in layman's language. One part of the epic describes, for example, test tube babies.

These propositions are considered defendable and have been approved as such by the supervisor prof. C. H. van der Wal.

Eindhoven, January 2017